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Ford

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(54) **COLD BEVERAGE REFILL SYSTEM**

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(52) **U.S. Cl.** **222/56**; 222/64; 222/129.2; 222/129.1; 222/142; 222/146.6; 222/137; 222/392; 222/62; 222/188; 222/342
(58) **Field of Search** 222/1, 56, 64–66, 222/146.6, 129.1–129.4, 135, 138, 142, 148; 62/188, 342, 343; 137/392

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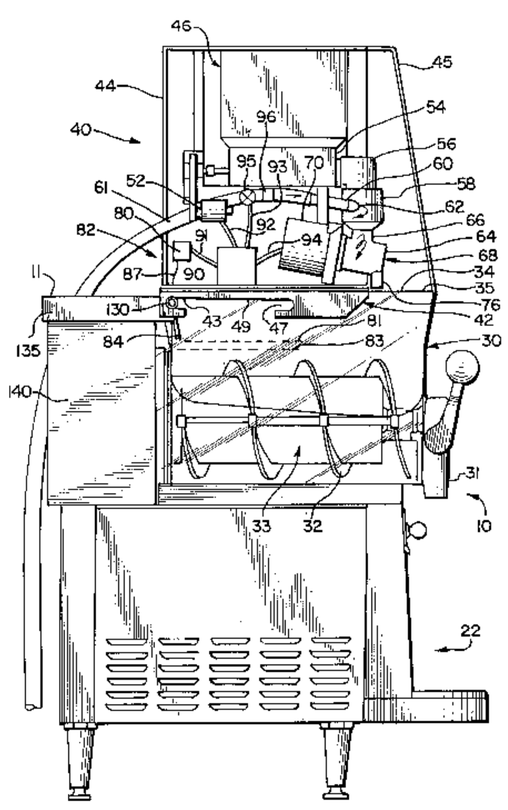
(57) **ABSTRACT**

A cold beverage dispensing system for chilling a beverage such that at least a portion of the beverage includes a frozen component. The system includes a beverage hopper or tank for retaining a quantity of beverage and a chilling assembly communicating with the beverage hopper for chilling the beverage. The system also includes a beverage detector having a conductive probe carried on and extending into the beverage hopper for detecting the condition of either the presence or absence of a beverage at a predetermined level in the beverage hopper and generating a refill control signal corresponding to the condition detected. A refill assembly communicates with the beverage hopper for controllably providing refill beverage to the beverage hopper. A controller is coupled to the refill assembly and the beverage detector for operating the refill assembly in response to the refill control signal to maintain the beverage in the beverage hopper at the predetermined level.

20 Claims, 4 Drawing Sheets



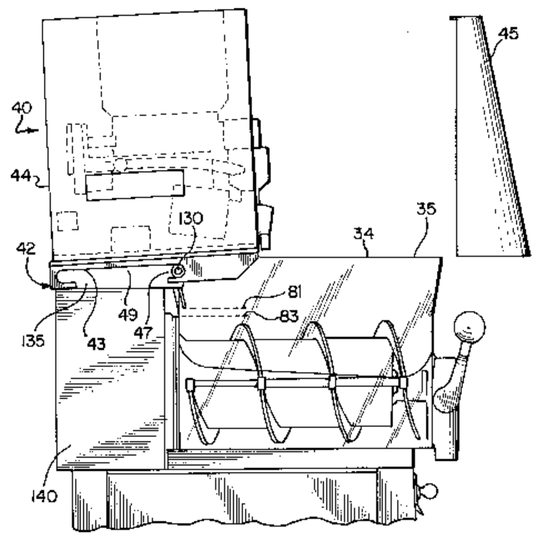


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FIG. 1

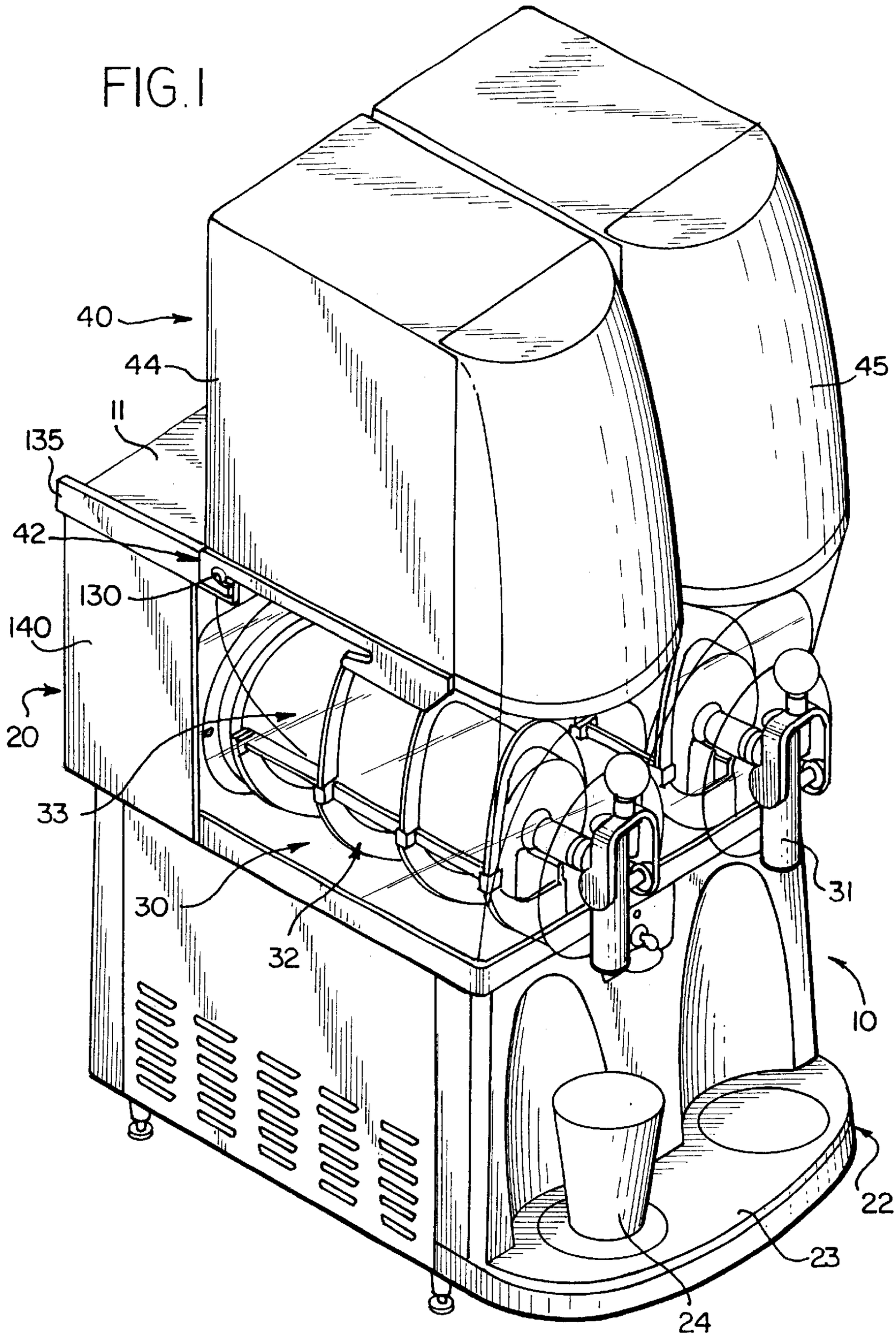
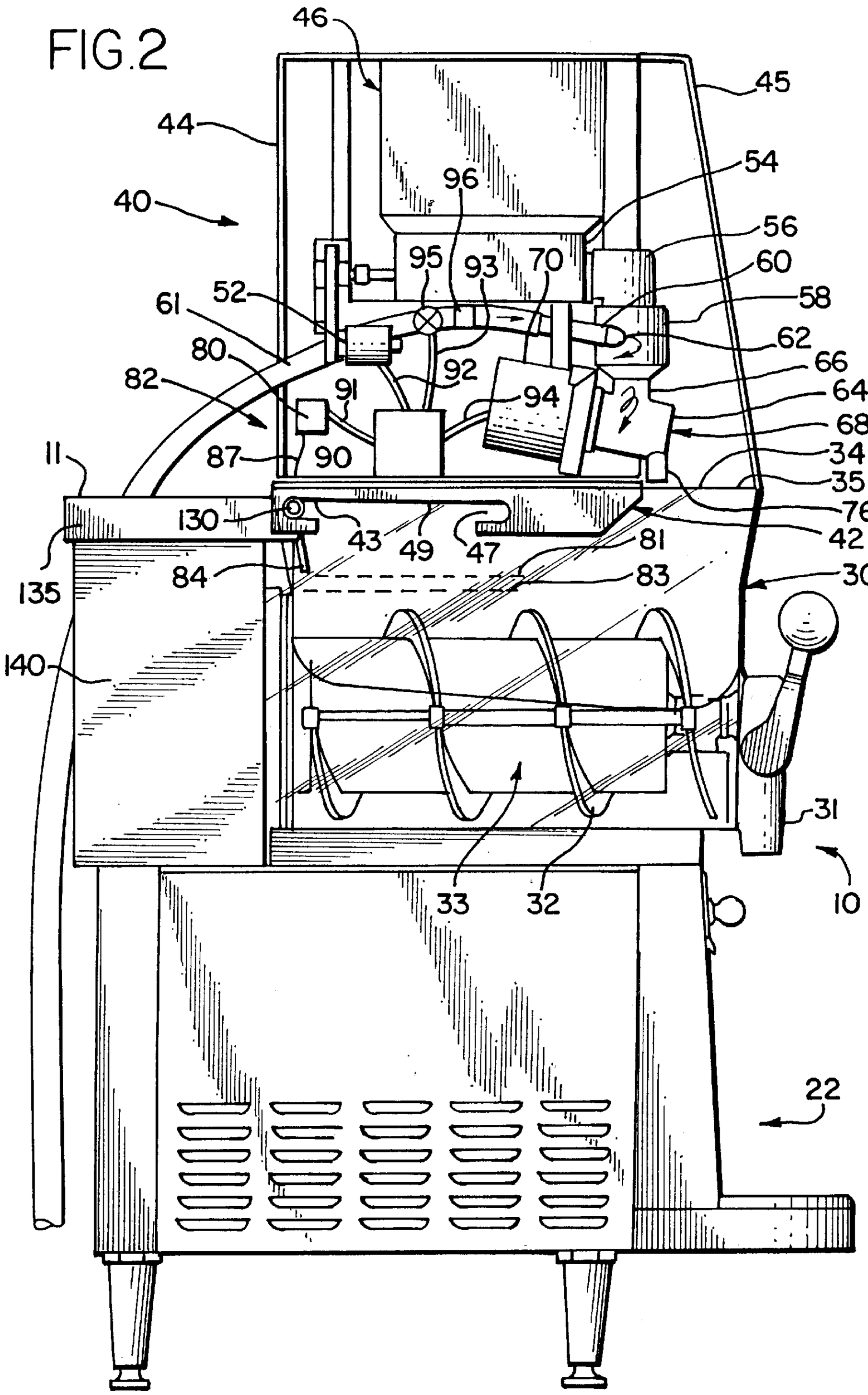


FIG.2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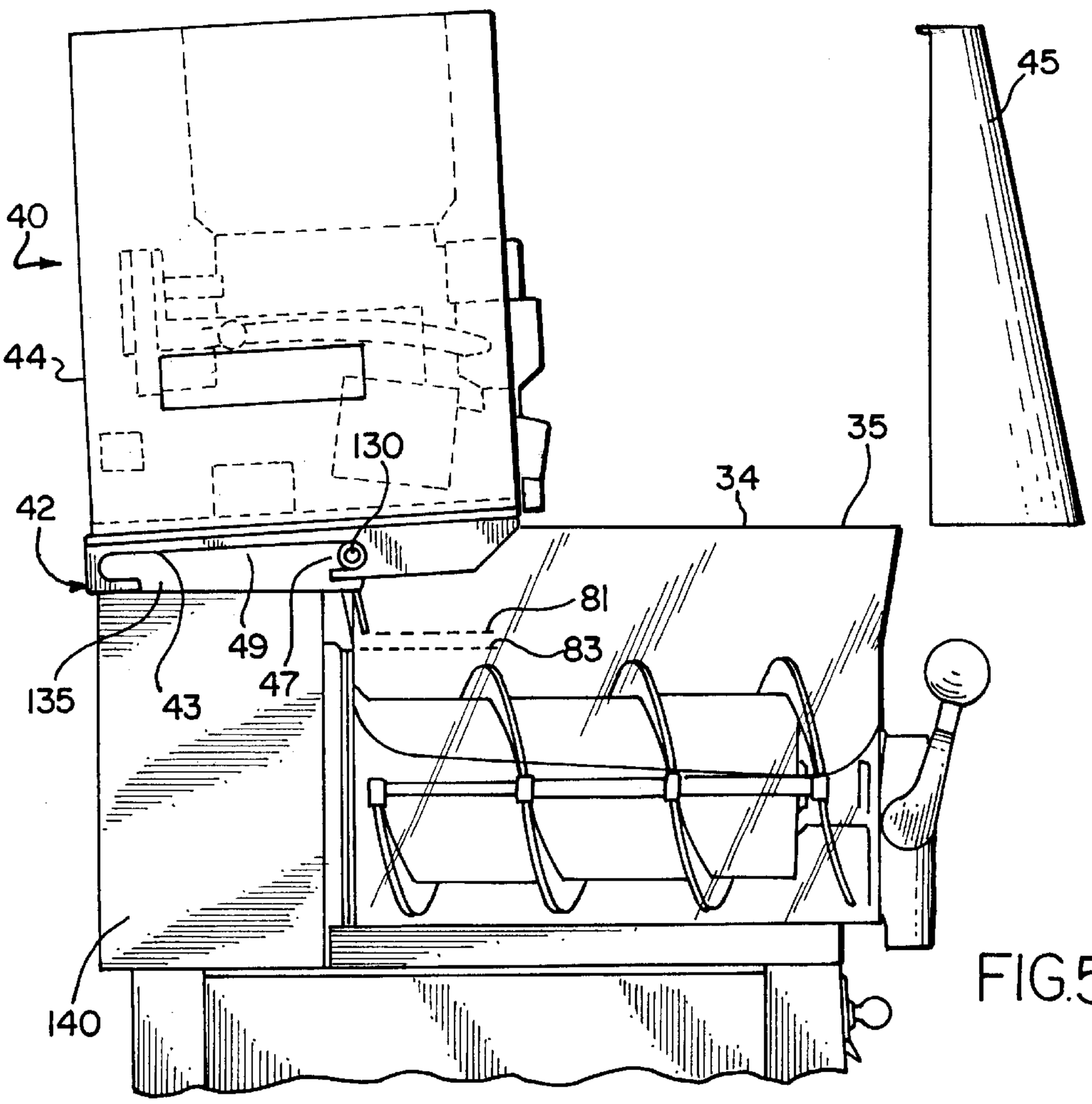
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FIG.5

FIG.3

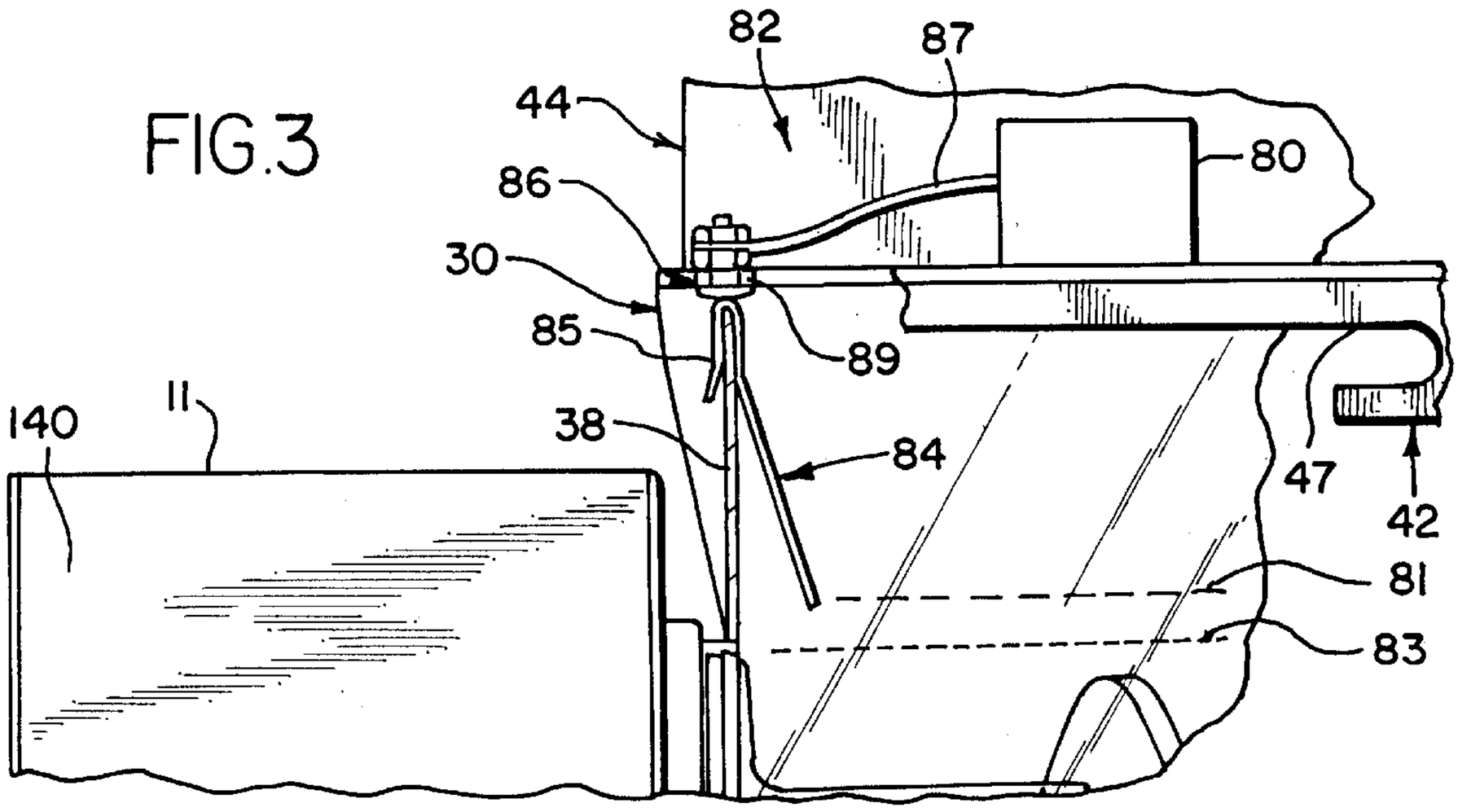
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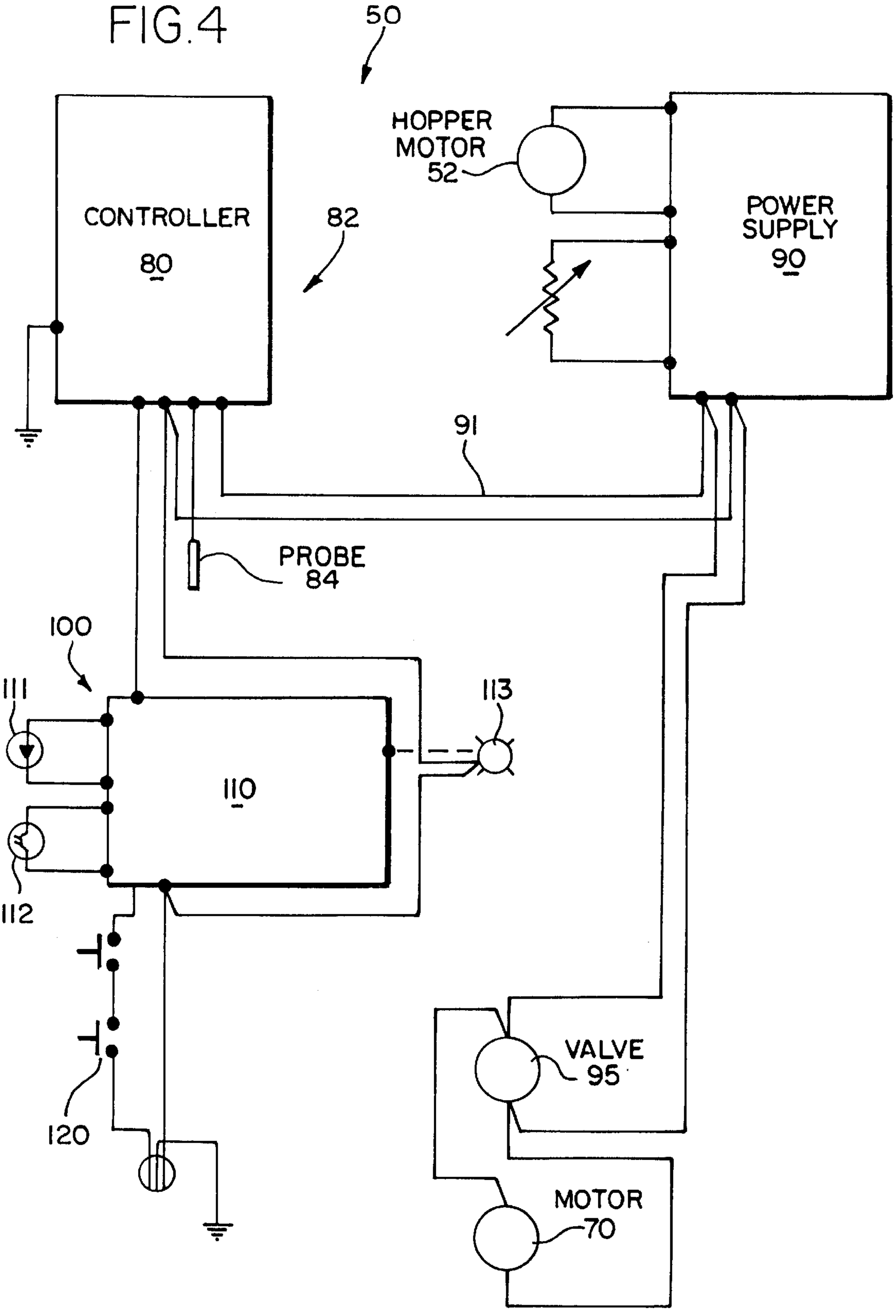
FIG.4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CONTROLLER
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POWER SUPPLY
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PROBE
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100
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112
120
VALVE
95
MOTOR
70

COLD BEVERAGE REFILL SYSTEM

RELATED APPLICATION

This application is based on provisional U.S. application Ser. No. 60/132,459 filed May 4, 1999.

BACKGROUND

A variety of cold beverage dispensing systems have been designed to produce chilled beverages, such as frozen or slush beverages, chilled juice drinks, chilled alcoholic mixtures, milkshakes, etc. A typical cold beverage dispensing system may include a beverage hopper in the form of the tank or the like retaining a beverage in the form of a mixture of beverage concentrate and water, and a chilling structure for chilling the beverage to form a chilled beverage. The beverage concentrate may be in the form of a syrup or a powdered concentrate. Some form of blade or auger is provided which moves relative to the chilling portion to circulate the beverage along the chilling portion and within the beverage hopper. Circulation of the beverage along the chilling portion helps to reduce the temperature of the beverage.

Prior art cold beverage dispensing systems do not adequately address the difficulty of continuously dispensing quality chilled beverages. The degree of freezing and texture of a chilled beverage is important in providing a quality beverage. Similarly, the consistency of the freezing and texture is very important to customers in ordering drinks. Additionally, in the food service business, where efficiency is desirable if not necessary, it is important to be able to provide such beverages readily and continuously without having to encounter waiting time in waiting for the beverage to chill or freeze.

In the conventional refilling operation, for example, during each refill cycle, additional refill liquid is added to the beverage hopper when the supply of beverage within the beverage hopper has been reduced to a certain low level or depleted. Thus, each time a refill cycle is performed a relatively large volume of refill liquid needs to be chilled or frozen. This results in a long delay or waiting period before the next batch of chilled or frozen beverage is ready for dispensing or, alternatively, results in dispensing of an unsatisfactory beverage.

There are other shortcomings associated with prior art cold beverage dispensing systems. For example, conventional refilling operations are somewhat labor-intensive, inaccurate, and difficult to clean, increasing the operational costs of the cold drink system.

Additionally, because known prior art refilling systems are manual, such systems are susceptible to potential operator-related errors. For example, splashing of the beverage onto the system may occur during a refilling operation, leaving a sticky, residue on the machine. Moreover, an operator usually has to prepare the beverage by mixing an amount of beverage concentrate (e.g., syrup) with water. Thus, it is possible that beverage of an incorrect concentration may be prepared because of inaccurate measuring of the beverage concentrate and/or water. This, in turn, can adversely affect the taste of the beverage, result in inconsistent product quality, as well as affect the economic efficiency of the system, all of which are undesirable. Furthermore, the large quantities of beverage which must be lifted above and poured into the beverage hopper are heavy and unwieldy. Thus, the refilling operation can be difficult.

One prior art cold beverage dispensing system that is available which attempts to overcome some of the above-

mentioned difficulties includes a refill tank coupled to the beverage hopper. The refill tank, which retains a quantity of premixed beverage or beverage mixture, is remote from the beverage hopper and is coupled to the beverage hopper by one or more hoses. When the supply of beverage or liquid in the beverage hopper has been depleted, the refill tank supplies the beverage hopper with additional beverage through the hoses. Such system, however, suffers from a number of deficiencies. In particular, the hoses do not drain effectively and, as a result, the liquid or beverage mixture stands in the hoses between refilling cycles. This can cause blockages in the hoses and possibly result in system shutdown. The beverage in the hoses contacts the entire surface area of the hoses and, therefore, may take on undesirable flavors, such as when the hose was previously used for a different flavor. As such, the flavor may be inconsistent and may adversely affect the taste of the chilled beverage.

Further drawbacks of such a prior art system are that the refill tank assembly requires considerable space, the system is awkward to set up, and is difficult to clean. Moreover, the system does not solve or avoid the problem of undue delay each time an additional batch of chilled beverage is prepared. Specifically, each time the beverage hopper is refilled, there still may be a considerable waiting period before the beverage is ready for dispensing, because of the time necessary to chill the beverage.

OBJECTS AND SUMMARY

Accordingly, it is a general object of the present invention to provide a cold beverage dispensing system, for chilling a liquid to produce a beverage having a frozen component, that includes an improved automatic refill assembly that desirably is effective and efficient.

A further object of the present invention is to provide such a cold beverage dispensing system having an automatic refill assembly and a beverage detector within a beverage hopper which enable the chilled beverage to be dispensed continuously without requiring a waiting time as servings of chilled beverage are dispensed.

A further object of the present invention is to provide such a cold beverage dispensing system that uses a powdered beverage concentrate and that includes a beverage refill concentrate hopper and a refill hopper detector for detecting either the presence or absence of beverage concentrate within the beverage refill concentrate hopper.

A still further object of the present invention is to provide a cold beverage dispensing system that includes a housing, a beverage hopper or tank, and a refill assembly that is secured to a housing and slides relative to the beverage hopper.

In accordance with these and other objects, the present invention provides a cold beverage dispensing system for chilling a beverage such that at least a portion of the beverage includes a frozen component. The system includes a beverage hopper or tank for retaining a quantity of beverage and a chilling assembly communicating with the beverage hopper for chilling the beverage. The system also includes a beverage detector having a conductive probe carried on and extending into the beverage hopper for detecting the condition of either the presence or absence of a beverage at a predetermined level in the beverage hopper and generating a refill control signal corresponding to the condition detected. A refill assembly communicates with the beverage hopper for controllably providing refill beverage to the beverage hopper. A controller is coupled to the refill assembly and the beverage detector for operating the refill

assembly in response to the refill control signal to maintain the beverage in the beverage hopper at the predetermined level.

The refill assembly is adapted to produce the refill beverage by mixing with water a beverage concentrate, such as a powdered concentrate or syrup. In the preferred embodiment, the concentrate is a powdered concentrate and the refill assembly includes a beverage refill concentrate hopper for retaining a quantity of powdered concentrate and a mixing assembly including a water inlet and a mixing device. The mixing assembly communicates with the dispenser hopper for receiving a quantity of powdered concentrate therefrom and for mixing the quantity of powdered concentrate with a quantity of water dispensed from the water inlet which is mixed by the mixing device. The mixing assembly communicates with the beverage hopper for dispensing the mixture of water and powdered concentrate into the beverage hopper desirably in a thoroughly dissolved and mixed liquid form.

A cold beverage dispensing system in accordance with a preferred embodiment of the present invention provides many advantages. For example, because of the beverage detector, quality chilled beverages can be supplied readily and continuously. The beverage detector functions to ensure that the predetermined beverage level within the tank remains constant and to control the degree of freezing, texture and consistency of the dispensed chilled beverage. The beverage detector is a novel aspect of the present invention and a significant improvement over the prior art.

The cold beverage dispensing system is effective and efficient and easy to set up and convenient to clean and maintain. Due to its construction, it also reduces the likelihood of contamination of the chilled beverage with old refill beverage.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of a cold beverage dispensing system according to the invention;

FIG. **2** is side elevational, partial cross-sectional view of a refill assembly according to the invention;

FIG. **3** is an enlarged side elevational view of a portion of a control assembly according to the invention;

FIG. **4** is a schematic diagram of the control assembly according to the invention; and

FIG. **5** is a side elevational view of a cold beverage dispensing system according to the invention with the refill assembly moved to the rear of the system to facilitate cleaning and maintenance.

DETAILED DESCRIPTION

A cold beverage dispensing system **10** in accordance with a preferred embodiment of the invention, which is illustrated in FIG. **1**, includes a housing or base **20** and at least one beverage hopper **30**. Each beverage hopper **30** is positioned on the housing **20** and retains a quantity of liquid or beverage ready for dispensing. In the illustrated embodiment two beverage hoppers **30** are shown; it will be apparent to those skilled in the art, however, that it may be desirable to provide a single beverage hopper **30** as well as three or more beverage hoppers **30**.

The cold beverage dispensing system **10** also includes a refill assembly **40** associated with each beverage hopper **30** for controllably dispensing refill beverage into the beverage hopper **30**. Desirably, each refill assembly **40** is secured to the housing **20**, is positioned above its associated beverage hopper **30**, and is slidable relative to the beverage hopper **30**.

Control system **50** (FIG. **4**) also forms part of the cold drink system **10**. The control system **50** is coupled to the refill assembly **40** to control production of and the supply of refill beverage to the beverage hoppers **30** and to maintain the beverage at a predetermined level as explained below.

The illustrated housing **20** includes a dispensing area **22** for receiving a beverage dispensed from a beverage hopper **30**. The dispensing area **22** may include a platform **23** on which a cup or receptacle **24** may be placed for receiving the beverage from the beverage hopper **30**. In this regard, a dispensing nozzle **31** may be coupled to each beverage hopper **30** for dispensing beverage into a receptacle **24**. The dispensing nozzle **31** preferably extends from a corresponding beverage hopper **30** so that it is positioned above the platform **23**.

As illustrated, each beverage hopper **30** preferably includes an auger assembly **32** for mixing and circulating the beverage retained within the beverage hopper **30**. The auger assembly **32** desirably comprises a generally helical auger blade adapted for rotation about a generally horizontal axis. It will be apparent to those skilled in the art, however, that a different auger or mixing assembly **32** could be used without departing from the spirit of the invention. For example, a paddle structure could be used. It should be noted that the present invention also envisions a cold drink system **10** in which no auger or mixing assembly **32** is positioned within each beverage hopper **30** and movement of a chilled beverage is accomplished using other means. The refill assembly **40** of the present invention will find utility with any of these cold beverage dispensing systems as well as others.

In the preferred embodiment as illustrated, each beverage hopper **30** communicates with a chilling assembly **33** for chilling the beverage within the beverage hopper **30**. The chilling assembly **33** and auger assembly **32** are both retained within a corresponding beverage hopper **30**. It is also preferred that the chilling assembly **33** be positioned proximate the auger assembly **32**.

As described in U.S. Pat. Nos. 5,918,768 and 5,927,553, which are incorporated herein by reference, the housing **20** also includes an auger drive motor for driving the auger assembly **32** via a shaft and a coolant system for providing the chilling assembly with a chilling effect.

As stated above, the refill assembly **40** desirably is positioned above, and slidable with respect to, a corresponding beverage hopper **30**. Advantageously, the refill assembly **40** supplies refill beverage directly into the beverage hopper **30**. This in turn reduces the time necessary for supplying refill beverage to the beverage hopper **30** and thus the time for a refilling cycle. Additionally, such positioning of the refill assembly **40** obviates the use of hoses and similar coupling devices for delivering beverage to the refill assembly, and thereby avoids the problems associated with the use of such coupling devices to connect a refill assembly to a beverage hopper. Positioning of the refill assembly **40** above the beverage hopper **30** minimizes the overall space requirements or "foot print" of the cold drink system **10**. In this regard, it is well known that in the typical environment (e.g., restaurants) in which cold drink systems **10** are used, space is at a premium.

In a preferred embodiment of the present invention, the refill assembly **40** is positioned on top of the beverage

hopper **30** partially covering a mouth **35** of the beverage hopper **30**. The rear of the refill assembly **40** is aligned with the rear of the beverage hopper **30**, leaving a front portion **34** of the beverage hopper **30** uncovered. The refill assembly **40** includes guide rails **42** to facilitate sliding of the refill assembly **40** relative to the beverage hopper **30**. In particular, first and second rails **42** are provided, positioned on first and second opposite sides respectively of the refill assembly **40**. The guide rails **42** preferably substantially center the refill assembly **40** over and suspend it above the mouth **35** of its corresponding beverage hopper **30**.

As shown in FIG. **2**, the guide rails **42** are connected to the base of a refill assembly housing **44**. The refill assembly housing **44** retains components for producing and supplying the additional beverage and protects them from the external environment. A front cover or hood **45** is also provided for covering and restricting access to the refill assembly components. The front cover or hood **45** attaches to the front face and encloses the front of the refill housing **44**. Additionally, a lower portion of the front cover **45** encloses the mouth **35** of the beverage hopper **30**.

As shown in FIG. **5** and described in greater detail hereinbelow, the refill assembly **40** is moved backwardly from its position covering the mouth **35** of the beverage hopper **30**. When moved backwardly, the refill assembly **40** tilts upwardly to fully open the beverage hopper **30**. As such, the beverage hopper can be removed from the housing of the apparatus for thorough cleaning. It should be noted, however, that the refill assembly **40** is still engaged with and carried on the base **20**. This is an improvement over the prior art which required removing and assembly from the housing and placing it on another surface. It will be appreciated that removal from the assembly can subject the refill assembly to unnecessary contamination or damage. As such, the displaceable refill assembly is retained on the base yet fully disengages the beverage hopper for removal of the hopper is a substantial improvement over the prior art.

As stated above, the refill assembly **40** of the present invention not only supplies refill beverage to the beverage hopper **30**, but also controllably and automatically produces the refill beverage it supplies. Advantageously, this means that operator-related errors associated with the preparation of additional or refill beverage are avoided, e.g., preparation of a beverage of the incorrect concentration. In the preferred embodiment of the present invention, the refill assembly **40** produces additional beverage by mixing a quantity of dry powdered concentrate with water.

The refill assembly **40** includes beverage concentrate dispenser hopper, desirably in the form of powdered concentrate dispenser hopper **46**, retained within the housing **44**. The powdered concentrate dispenser hopper **46** retains a quantity of dry powder beverage concentrate. The powdered concentrate dispenser hopper **46** communicates with a stirring and dispensing mechanism (not illustrated) for stirring the powdered concentrate within the powdered concentrate dispenser hopper **46** and dispensing powder therefrom. The stirring and dispensing mechanism includes a hopper motor **52**. The construction of the stirring and dispensing mechanism is substantially the same as that described in U.S. Pat. Nos. 5,918,768 and 5,927,553, to which reference is again invited.

As shown in FIG. **2**, the illustrated refill assembly **40** also includes a first passage **58** which communicates with the powdered concentrate dispenser hopper **46**. The first passage **58** receives a quantity of powdered concentrate dispensed from the powdered concentrate dispenser hopper **46** through an outlet **54** and an elbow **56**. A water inlet **60** dispenses water into the first passage **58** when the powdered concentrate is dispensed from the hopper. The water inlet **60** couples the refill assembly **40** to a water source, preferably with a positive pressure. In this regard, a hose **61** may be provided for coupling the water inlet **60** to a water source. The water inlet **60** includes a tangential entry aperture **62**. The tangential entry aperture **62** introduces water in a tangential orientation to produce and promote swirling of the water in the first passage **58**. The swirling action promotes dissolving of the powdered concentrate in the water and the cleansing of the first passage surfaces at the completion of the refill cycle.

The first passage **58** communicates with a second passage **64**. The combined powder and water from the first passage **58** drain into the second passage **64** through a coupling **66**. A blending mechanism **68** (not illustrated) is retained within the second passage **64** to mechanically combine the powder and water. The blending mechanism **68** includes a motor **70** (FIG. **2**) and a mixing blade substantially as shown and taught in the above-referenced applications. Agitation quickly, thoroughly mixes the powder in water combination to assure complete dissolving of the powder in the water. The resultant liquid beverage refill mixture is dispensed from the second passage **64** through the dispensing outlet **76** and into the beverage hopper **30**.

In providing a quality chilled beverage, it is also desirable to assure complete dissolving of the powder in the water. The powder is in a granular form including sugar and flavor components. Of course, the flavor components may be carried in the granular sugar. Nevertheless, there is a granular component to the powder which typically does not fully dissolve upon the initial introduction to the water. As such, the blending mechanism **68** mechanically combines the water and the granular powder.

In this regard, complete dissolving of the powder in the water is assured. The complete dissolving of the powder in the water prevents damage to the mixing assembly and chilling assembly. In this regard, if the granular powder concentrate is not fully dissolved in the water upon introduction to the beverage hopper, the grains may cause abrasion as they are moved by the helical auger forwardly from the rear of the beverage hopper towards the front along the outside surface of the chilling assembly. Such abrasion will unnecessarily wear the auger relative to the chilling assembly and the chilling assembly relative to the auger. This wear may result in a gap of undesirable dimension forming between the auger and the chilling assembly thereby reducing the effectiveness of the system. This is especially important since the present system chills beverages to a temperature range near to and slightly above or at the freezing point of the beverage. As such, if the powder concentrate is not fully dissolved in the water prior to entry into the beverage hopper, it is unlikely, due to the reduced temperature, that further dissolving will occur. There are a number of prior art devices which do not produce a chilled or frozen beverage. Rather, they provide a cooled fully liquid beverage. In these types of devices, when a user adds a large volume of mixture to the beverage hopper, the agitating action will further disperse and assure dissolving of any undissolved particulars. These types of devices do not use the auger and chilling assembly arrangement and therefore do not encounter the wear problems which the present invention overcomes. Rather, because of the cooled but not chilled nature of the beverage retained in the prior art devices, further dissolving of the powder in the beverage will occur.

As an additional consideration, the present invention must reduce the temperature of refill beverage quickly so as not to

reduce the frozen texture of the remaining portion of the beverage in the beverage hopper. In this regard, the use of the blending mechanism **68** assures that a fully dissolved beverage refill portion is introduced into the beverage hopper.

Thus, advantageously, in the present invention, additional beverage mixture is dispensed directly from the refill assembly **40** into the beverage hopper **30** without the use of hoses or other awkward connection means. Accordingly, delivery of additional beverage mixture is quick, efficient and simple. Additionally, the gravity-feed construction of the dispensing outlet **76** and its short length prevent accumulation of beverage mixture therein and thus mixing with the residue of a previous dispensing cycle.

The manner of preparing the refill beverage mixture in the present invention also provides advantages. Specifically, the use of a powdered concentrate to form the refill beverage, rather than a non-powdered liquid concentrate such as syrup, reduces the space requirements of the system **10** and makes the system **10** easier to use. The space requirements are reduced because only a relatively small volume of powder is required to produce a relatively large volume of beverage. Accordingly, only a relatively small volume of powder needs to be stored in the refill assembly **40** to produce enough beverage for many refill cycles. Additionally, the powdered concentrate is relatively light. This facilitates handling of the powdered concentrate, when the powdered concentrate hopper **46** is refilled. Furthermore, use of a powdered concentrate helps increase the operational efficiency of the cold drink system **10**. In particular, more refill cycles can be performed than in prior art systems before it becomes necessary to supply additional powdered concentrate (i.e., beverage mix) to the refill assembly **40**.

Production and supplying of refill beverage from the refill assembly **40** to the beverage hopper **30** is regulated by a controller **80**. The controller **80** controls the refill assembly **40** so that a desired predetermined level of beverage is maintained in the beverage hopper **30**. This predetermined level is schematically shown by the dashed line **81** in FIG. **2**. Specifically, the controller **80** detects when the beverage in the beverage hopper **30** is not present at the desired level **81** in which case it activates the refill assembly **40** in response to supply additional beverage to the beverage hopper **30**. A beverage detector **82** is provided for indicating to the controller **80** when the beverage is not present at the desired level **81**. Dashed line **83**, which is intended to schematically represent any level below the probe **84**, illustrates beverage not present at level **81**. Inasmuch as any level below level **81** will be detected by probe **84**, the distance between **81** and **83** is exaggerated in the drawings simply for illustrative purposes.

In view of The National Sanitation Foundation Rules, it is undesirable to position a probe on the housing in any manner in which the probe would provide surfaces or recesses in the "food area". In this regard, The National Sanitation Foundation has standards which require ease of cleaning or removal for cleaning, without using tools, of parts which are in the "food area". As such, any refill device used with a frozen beverage type of cold drink system as taught herein must be easily cleaned within these standards. Additionally, a problem is created by the need to have a beverage detector which allows the housing to slide relative to the beverage hopper, as will be described in greater detail hereinbelow. As such, prior art techniques of hanging a probe directly from the housing are completely unusable in the present invention.

The controller **80** preferably comprises a beverage circuit and is retained within the refill assembly housing **44**. The beverage detector **82** includes a probe **84**. As best illustrated in FIG. **3**, the probe **84** is carried on a rear wall **38** of beverage hopper **30** and extends a predetermined distance into the beverage hopper **30**. The probe **84** preferably includes an upper portion **85** to facilitate clipping or hooking of the probe **84** onto the rear wall **38** of the beverage hopper **30**. The probe is also easily removable from the beverage hopper wall for purposes of cleaning in accordance with The National Sanitation Foundation guidelines. In a preferred embodiment, the probe **84** comprises a conductivity probe and the controller **80** is adapted to detect the conductivity of the probe **84**. Specifically, the probe **84** is conductive when beverage contacts the probe **84** and is not conductive when the beverage ceases to contact the probe **84** or, in other words, when the end of the probe **84** is exposed to air.

As stated above, it is preferred that the controller **80** be retained within the refill assembly housing **44** and the probe **84** be carried on and extend into the beverage hopper **30**. In this regard, a contact element **86** is provided for coupling the controller **80** to the probe **84**. As illustrated in FIG. **3**, the contact element **86** is carried by the refill assembly housing **44** and coupled to the controller **80** by an electrical lead **87**. The contact element **86** preferably extends through the base of refill assembly housing to couple the controller **80** to the probe **84**. It is also preferred that the contact element **86** be biased into engagement with the beverage detector **82**. In this regard, a spring **89** may be provided for biasing the contact element **86** into engagement with the probe **84**. As shown, the contact extends a nominal distance from the bottom of the base of the refill assembly. The contact does not interfere with the sliding movement of the assembly relative to the beverage hopper. The contact provides conductive coupling of the controller to the probe and provides easily cleanable surfaces which will satisfy The National Sanitation Foundation standards.

In a preferred embodiment, the controller **80** detects through the contact element **86** whether the probe **84** is conductive, and hence whether beverage is present at the desired predetermined level **81**. Specifically, when the beverage in the beverage hopper **30** ceases to contact the probe **84**, the probe **84** ceases to be conductive. The controller **80** detects the lack of conductivity through the contact element **86** and in response activates the refill assembly **40** to supply refill beverage to the beverage hopper **30**. If desired, a momentary time-delay mechanism in any suitable form may be included before activating the refill assembly to ensure that the lack of conductivity is not caused by momentary turbulence in the liquid.

The activation of the refill assembly **40** will now be described with reference to FIGS. **2** and **4**. When the controller **80** determines through the contact element **86** that the beverage is no longer present at the desired predetermined level **81**, the controller **80** activates a power supply **90**. The controller **80** is coupled to the power supply **90** via a control line **91**. Activation of the power supply **90** opens a water inlet valve **95** so that pressurized water flows into the mixing chamber **58**. In accordance with well known practices, a flow controller **96** is provided on the inlet line to regulate the flow of water and maintain flow of water at a predetermined rate. In a preferred embodiment of the present invention, the water inlet valve **95** comprises a solenoid valve. As shown in FIG. **2**, the power supply **90** is coupled to the inlet valve **95** by a control line **93**.

Simultaneously, the power supply **90** also activates the powdered concentrate hopper motor **52** and mixing motor **70** so that a preselected quantity of dry powdered beverage concentrate is dispensed and mixed with a preselected

quantity of the incoming water. Preferably, the powdered concentrate hopper motor **52** comprises a DC gear motor. As illustrated in FIG. **2**, the power supply **90** is coupled to the powdered concentrate hopper motor and motor **70** by control lines **92** and **94**, respectively.

Refill beverage mixture is prepared and dispensed to the beverage hopper **30** until the beverage in the beverage hopper **30** contacts the probe **84** and causes it to be conductive. When the controller **80** detects the conductivity of the probe **84**, it deactivates the power supply **90**. This in turn causes the inlet valve **95**, powdered concentrate hopper motor **52**, and motor **70** to be shut off, thereby completing the refill cycle.

Advantageously, in the present invention, the controller **80** is adapted to control the refill assembly **40** so that additional beverage is supplied to the beverage hopper **30** as beverage is dispensed therefrom. Specifically, each time a quantity of beverage is dispensed from the beverage hopper **30**, additional or refill beverage is supplied substantially simultaneously to the beverage hopper **30**. By refilling the beverage hopper **30** in this manner, only relatively small amounts of refill beverage are added to the beverage hopper **30** each time a refill operation is performed. Because only relatively small amounts of refill beverage are added, it takes only a nominal amount of time to freeze the additional or refill beverage to the desired temperature. Minimizing the refreeze time in the chilled or frozen drink system of the present invention is very important. In a prior art cold beverage dispensing system which dispenses cold beverages which has no frozen component, the concentration or flavor as well as the temperature are important. However, in cold beverage dispensing systems, the type in which the beverage includes a frozen component, the degree of freezing or texture is also very important, and is a characteristic which customer come to expect. The incremental addition of refill beverage is important in maintaining the texture since the small quantity of refill beverage is nominal in relation to the entire quantity in the beverage hopper and is quickly integrated and frozen to the desired temperature. Accordingly, the present invention essentially eliminates the considerable waiting period associated with the refilling operation in the prior art.

As shown in FIG. **4**, a control assembly **100** is also provided for ensuring that the additional liquid mixture supplied to the beverage hopper **30** is of a desired composition. Specifically, a hopper level detector circuit or a sensor **110** is provided for determining whether there is a sufficient quantity of powdered concentrate in the powdered concentrate hopper **46** is available to produce refill beverage of the desired composition. In the present invention, the sensor **110** preferably comprises an emitter **111** and a detector **112** mounted on opposite sides of the powdered concentrate hopper **46**. When there is a sufficient level of powdered concentrate within the hopper **46**, the powdered concentrate prevents the light beam from the emitter **111** from reaching the detector **112** mounted on the opposite side of the powdered concentrate hopper **46**. When the powdered concentrate is not at a predetermined level in the hopper **46**, the detector **112** then senses the light from the emitter **111** and causes the refill assembly **49** to be shut off. Alternatively, the sensor **110** may also cause either a visual signal, such as a low hopper indicator light **113** to be lit or an audio signal to be produced, indicating to an operator that the hopper **46** needs to be refilled.

The sensor **110** of the present invention provides a particular advantage and solves a problem unrecognized by the prior art, when used in conjunction with a cold beverage dispensing system for producing a partially frozen beverage. In such a cold beverage dispensing system, the sensor **110** of the present invention prevents water only or water with insufficient powdered beverage to be dispensed to the beverage hopper **30**. Such a situation is undesirable because it could result in formation of a hard ice, which would be difficult to shave off the chilling assembly, could possibly lock-up the auger mechanism, put stress on the drive motor, and/or otherwise damage the cold beverage dispensing system. The prior art cold beverage dispensing systems which serve liquid, unfrozen beverages could not appreciate the importance of this improvement. While this control system would impact the flavor of the drink in the prior art system, the prior art system would not have been damaged in the absence of such a system.

As discussed above, the refill assembly **40** is positioned above the beverage hopper **30** on a pair of guide rails **42**. In the present invention the rails **42** are adapted to guide the assembly **40** as it is slidably moved relative to the beverage hopper **30**. Advantageously, this allows the refill assembly **40** to move horizontally forward and backward to provide access to or covering of the beverage hopper **30**. This greatly facilitates the cleaning of the beverage hopper **30** in place, as well as removal of the beverage hopper from the housing. As is well known in the art, the beverage hopper **30** must be cleaned periodically for sanitation reasons. Because the refill assembly **40** can be slid to cover or reveal at least a portion of the mouth of the beverage hopper **30**, access to the interior of the beverage hopper **30** is easily provided and cleaning of the beverage hopper **30** is simplified. Also, the rails **42**, advantageously retain the assembly on the system **10** to prevent casual or accidental removal thus reducing the possibility for damage of the assembly.

It should be noted that although in a preferred embodiment the refill assembly **40** is displaced relative to the beverage hopper **30** by a sliding action, other displacement assemblies could be used. For example, the refill assembly **40** could be tilted back from or lifted off of the beverage hopper **30** without the use of the rails **42**.

It will be apparent that as the refill assembly **40** is moved to expose the mouth of the beverage hopper **30**, the contact element **86** will be moved out of engagement with probe **84** and electrical contact between the controller **80** and probe **84** will be broken. It will be recalled that the controller **80** is adapted to activate the refill assembly **40** whenever a break in electrical contact with the probe **84** or a lack of conductivity is sensed. Accordingly, a switch **120** (FIG. **4**) is provided for deactivating the refill assembly **40** as it is moved away from the beverage hopper **30**. The switch **120** preferably comprises a proximity switch. The switch **120** automatically shuts down the refill assembly **40**, whenever the refill assembly is moved from the beverage hopper **30** to prevent undesired refilling of the beverage hopper **30**.

In a preferred embodiment, movement of the refill assembly **40** on the beverage hopper **30** is facilitated by a pair of cam followers **130** and a pair of support rails **135**. The support rails **135** are positioned on a housing **140** in which the auger drive motor is retained. In particular, one support rail **135** is positioned on a first side of the housing **140** and the other support rail **135** is positioned on a second opposite side of the housing **140**. The support rails **135** are positioned behind the beverage hopper **30** and in alignment with the sides of the beverage hopper **30**. The support rails **135** guide movement of the refill assembly **40** when it is moved rearwardly away from the beverage hopper **30** toward the housing **140**.

The cam followers **130**, which are positioned adjacent front portions of the support rails **135**, are adapted to engage

the rails **42**. Specifically, each rail **42** includes a notch **43** which fits around a cam follower **130** when the refill assembly **40** is in its operative position—i.e., aligned with the rear of the beverage hopper **30**. Engagement of the notch **43** with the cam follower **130** helps retain the refill assembly **40** in its operative position on the beverage hopper **30**; i.e., engagement of the notch **43** with the cam follower **130** prevents forward movement of the refill assembly **40** on the beverage hopper **30**. Engagement of the cam followers **130** with the rails **42** also facilitates movement of the refill assembly **40** onto and off of the beverage hopper **30**, as will be discussed shortly.

In use, when it is desired to clean the beverage hopper **30**, first the front cover **45** is removed. It will be recalled that the front cover **45** resists rearward movement of the refill assembly **40** and helps retain the refill assembly **40** in a position substantially aligned with the rear of the beverage hopper **30**. Once the front cover **45** is removed, the refill assembly **40** may be slid rearwardly away from the beverage hopper **30** toward the rear **11** of the cold drink system **10**. In particular, the rails **42** will slide along the followers **130** and on the support rails **42** to effect rearward movement of the refill assembly **40**. As the refill assembly **40** is moved rearwardly, the cam followers **130** will engage a sloped portion **49** (see FIG. **5**) of the rails **42**. Engagement of the cam followers **130** with the sloped portion **49** of the rails **42** will cause the refill assembly **40** to be lifted up and tilted back off the beverage hopper **30**.

As the refill assembly **40** is moved further rearwardly, it continues to tilt away from the beverage hopper **30**. Eventually the center of gravity of the refill assembly **40** will become located to the rear of the cam followers **130**. In the illustrated embodiment of the present invention, this occurs just before the refill assembly **40** is slid completely to the rear **11** of the cold drink system **10** and as the cam followers **130** engage front notches **47** of the rails **42**. Location of the center of gravity behind the cam followers **130** causes the refill assembly **40** to pivot back on the cam followers **130** and onto the housing part **140** as it is moved rearwardly. Thus, in the present invention, in its furthest rearward position the refill assembly **40** will be tipped back or tilted away from the beverage hopper **30** thereby providing access for cleaning. It should be noted that in this tilted back position engagement of the cam followers **130** with the front notches **47** prevents further rearward movement of the refill assembly **40** (see FIG. **5**).

Advantageously, the present invention also facilitates cleaning of the powdered concentrate dispenser hopper **46** and refill assembly **40**. In particular, removal of the front cover **45** will provide access to the powdered concentrate dispenser hopper **46** and the other components of the refill assembly **40**.

The tilting of the hopper in the rearward position as described above is also advantageous since it completely disengages the refill assembly from the mouth of the hopper. In this regard, all of the weight is carried by the cam followers **130** with a portion of the refill assembly **40**, perhaps, carried on the rear housing portion **140**. This is advantageous since the refill assembly **40** is maintained in engagement on the base while allowing removal of the beverage hopper **30** from the base for thorough cleaning. In this regard, the cam followers **30** are attached to the base independently of the beverage hopper so that the structure retaining and at least partially supporting the refill assembly **40** is not connected to the beverage hopper **30**. By carrying the refill assembly **40** on the base independent of the beverage hopper, a single operator can remove the beverage hopper for cleaning and replace it without complication, without tools, without assistance from another operator and without risk of damage to the apparatus. After cleaning, when the beverage hopper is replaced on the base, the refill assembly **40** is merely moved forwardly to its original position at least partially over the beverage hopper.

The operation of the present invention should be apparent from the foregoing, but it will be now briefly described. The cold beverage dispensing system **10** is operated by supplying a beverage in the beverage hopper **30**. The front cover **45** is attached to the refill assembly **40** and the beverage hopper **30** and then the system **10** is activated. Activation of the system **10** will result in rotation of the auger assembly **32** within the beverage hopper **30** and initiation of a cooling cycle. Cooling is provided by the chilling assembly **33**. As an external surface of the chilling assembly **33** begins to cool, the temperature of the beverage is decreased. The auger assembly **32** revolves to mix the beverage within the beverage hopper and increase the rate of cooling. The auger assembly **32** includes a helically configured blade which is positioned in close proximity to the external surface of the chilling assembly **33** which removes a thin sheet of frozen material from the chilling assembly **33** as it is rotated relative thereto. When a desired beverage temperature having a desired degree of frozen beverage component is attained, beverage may be dispensed through the dispensing nozzle **31** into a container **24** positioned there below.

As beverage is dispensed, when the beverage in the beverage hopper **30** ceases to contact the probe **84**, the probe **84** will cease to be conductive. The controller **80** will detect the lack of conductivity through the contact element **86** and activate the refill assembly **40**. Specifically, the power supply **90** will be turned on. This, in turn, will cause the water inlet valve **95** to be opened so that water flows into the first passage **58**. Simultaneously, the powdered concentrate hopper motor **52** will be activated so that a predetermined quantity or flow rate of powdered beverage concentrate is dispensed into the first passage **58**. The combined water and powdered beverage concentrate then pass through the second passage **64** where it is mixed further and then through the outlet **76** and into the beverage hopper **30**. The additional beverage mixture is produced and supplied as beverage is dispensed. Additional beverage is dispensed until the beverage in the beverage hopper **30** contacts the probe **84**.

Thus, an improved cold drink system **10** has been described. The cold beverage dispensing system **10** of the present invention includes the improved automatic refill assembly **40**. The refill assembly **40** of the present invention is efficient in construction, and easy to set up and convenient to maintain. Only two external hookups are necessary—i.e., a water hook-up and electrical hook-up. The refill assembly **40** is positioned above the beverage hopper. The refill assembly **40** simplifies and increases the efficiency of a refilling operation. No operator intervention is required and the additional or refill beverage is dispensed directly into the beverage hopper **30**. The refill assembly **40** also prevents contamination of the chilled beverage with old refill beverage, since there are no hoses or similar coupling devices in which refill beverage can accumulate. Moreover, the cold beverage dispensing system **10** of the present invention facilitates cleaning operations. By simple removal of the cover **45**, access to the interior of the refill assembly **40** is provided. Likewise, by simply displacing the refill assembly **40** rearwardly, access to the beverage hopper **30** is provided. Furthermore, the cold beverage dispensing system **10** of the present invention also provides an improved control system **50** which is simple in construction and

overcomes deficiencies of the prior art. For example, the control system **50** eliminates the waiting period associated with preparation of additional chilled beverage.

What is claimed is:

1. A beverage dispensing system comprising:

base structure;

at least one support attached to said base structure;

a beverage hopper for retaining a quantity of said beverage, said beverage hopper being retained on said base structure;

a dispensing device operatively coupled with said beverage hopper for dispensing beverage therefrom;

a refill assembly communicating with said beverage hopper for controllably providing refill beverage to said beverage hopper;

at least one guide attached to said refill assembly, said at least one guide being operatively couplable with said at least one support for maintaining said refill assembly on said base structure when said refill assembly is displaced relative to said beverage hopper.

2. The beverage dispensing system of claim **1** wherein the base structure includes a housing positioned rearward of the beverage hopper.

3. The beverage dispensing system of claim **2** wherein the support comprises a pair of support rails mounted to the housing.

4. The beverage dispensing system of claim **2** wherein said at least one guide is operatively couplable with said at least one support for maintaining said refill assembly on said housing.

5. The beverage dispensing system of claim **1** wherein the support comprises a pair of support rails.

6. The beverage dispensing system of claim **5** wherein the support includes a pair of cam followers associated with the pair of support rails, the cam followers engaging the at least one guide.

7. The beverage dispensing system of claim **6** wherein there are two guides, each cam follower engaging a respective guide.

8. The beverage dispensing system of claim **7** wherein each guide comprises a guide rail.

9. The beverage dispensing system of claim **1** wherein the refill assembly is tiltable relative to the beverage hopper between an open position and a closed position.

10. The beverage dispensing system of claim **1** wherein there are two guides.

11. The beverage dispensing system of claim **10** wherein each guide comprises a guide rail.

12. The beverage dispensing system of claim **11** wherein the support includes a cam follower, the guides being engaged with the cam follower.

13. The beverage dispensing system of claim **12** wherein the refill assembly is tiltable relative to the beverage hopper between an open position and a closed position.

14. The beverage dispensing system of claim **1** wherein the refill assembly is movable relative to the beverage hopper between forward and rearward positions.

15. The beverage dispensing system of claim **14** wherein the refill assembly is tiltable relative to the beverage hopper between an open position and a closed position.

16. The beverage dispensing system of claim **14** wherein the support includes a cam follower engaged with the guide.

17. The beverage dispensing system of claim **16** wherein the guide defines a pair of notches, the cam follower is received within one notch when the refill assembly is in its forward position and the cam follower is received within the other notch when the refill assembly is in its rearward position.

18. The beverage dispensing unit of claim **17** wherein there are two guides and two cam followers.

19. The beverage dispensing system of claim **18** wherein the support includes a pair of support rails engaged with the cam followers.

20. The beverage dispensing system of claim **19** wherein each guide comprises a guide rail.

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